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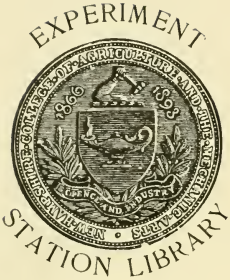

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FORESTRY

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II. Experiments: Digging, Packing and Transplanting.
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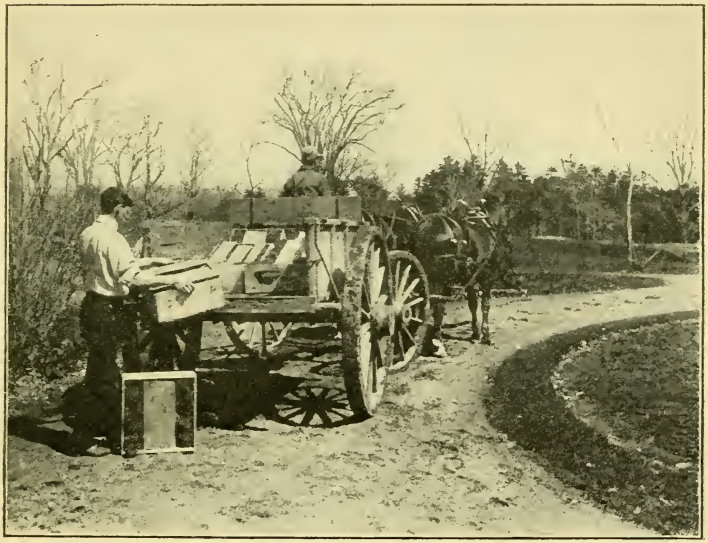

A New England Forest in Transportation.

BY F. WM. RANE

NEW HAMPSHIRE COLLEGE
OF
AGRICULTURE AND THE MECHANIC ARTS
DURHAM

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FORESTRY EXPERIMENTS

BY F. WM. RANE,

Professor of Horticulture and Forestry, New Hampshire College.

The object and purpose of this bulletin is to give the information which everybody in New England should have in regard to our native pine seedlings. We have been unable to find any literature on forestry sufficiently brief which, placed in the hands of a landowner, would enable him to go to work and do something by himself in a practical way. It was to give exactly this sort of information that Bulletins Nos. 95 and 106 were published. No. 95, "How to grow a forest from seed," was written with the purpose of giving the reader a general idea of forestry. Enough definite experimental data are found here so that a person can determine means, methods and expense.

No. 106, "How to make a beginning," and "Waste lands; how to convert them into forests." This bulletin classifies our lands that would make valuable forests, but at present are practically worthless, and tells how to handle each so as to get forests started upon them.

Both of the above bulletins are the results of studying practical New England forestry conditons. The writer went directly into the woods in different parts of the state, made a study of different kinds of soils in which trees are and have been growing, secured definite data and facts from farmers themselves, observed trees growing in all stages and conditions, etc. The nature of what people wanted to know was also determined from letters of inquiry of the college, from inquiries when traveling about the state, and discussions at public agricultural meetings.

FIG. 2. Two years after the forest was cut. Fire kept out and slash allowed to rot. In fine condition for restocking. Wild seedlings were set out here. Natural restocking in the background.

A limited supply of these bulletins is still available to those only who care to make definite use of them. They should be read in connection with this bulletin, in order to get a more complete idea of doing something in practical forestry.

Collect Native Seedlings on Your Own Farm or in Your Vicinity and Transplant Them.

After years of experience in purchasing and transplanting white pine seedlings from nurserymen, and endeavoring to make the restocking of lands to forests a simple and economic problem here in New England, I believe the keynote to the whole situation was reached when we demonstrated that the seedlings are already on hand if we will but look around for them. The only effort and expense necessary is to see that they are transplanted where they should go.

Upon careful examination the writer has found in different sections where the white pine (*pinus strobus*) is native, young natural seedlings in large numbers. It is to emphasize the importance of utilizing these resources already at hand and to give the public the benefit of our experience in handling them that this bulletin is offered.

Where Young Pine Seedlings (Trees) Can Be Found.

Wherever pine trees grow to any size, varying from six inches or more in diameter, they begin to bear cones, which are the seed bearing organs of the tree. When these cones mature, which is usually during the fore part of September in this latitude, they open up while still hanging on the trees, allowing the winged seed to fall out. These seeds are scattered, more or less, according to the wind blowing at the time. The seeds that fall in favorable places germinate and grow. It is from this source that our pine trees found so commonly throughout New England come. Nature is very bounteous and beneficent with us, for with all of our

destructive methods, she persists in presenting us with the second growth pine in sufficient quantity to be a great factor in our New England agriculture. Of the millions of

Fig. 3. Students digging pine seedlings in the college woods. Where improvement cuttings are made we have the ideal conditions for nature's nursery. Twenty-five thousand strong seedlings were dug from this area last year and plenty remain.

pounds of seeds scattered in this way on a seed year but comparatively a very small percentage ever survives to become a pine tree of any proportions. Insects, birds, squir-

rels, mice, etc., devour large portions of the seed before they germinate, and even those that do germinate are most often in unfavorable locations, as under heavy shade in the forest, or too much exposed and hence burned by the sun. The young white pine seedling is very tender and delicate when young, growing only about an inch in height the first year, and survives only when the conditions are favorable. It is claimed by some writers that the pine ripens seeds only once in seven years. Our experience has shown that there is no set rule to be followed, as we have seen very heavy seedings of the same trees only three years apart, and have observed trees producing a fair yield of cones two years in succession. It is believed the nature of the seasons has very much to do with this question. There are very few years but that pine seeds can be gathered in some sections of New England. In the fall of 1902 cones were extremely scarce generally, but this was exceptional.

The following season after a seed year, if one will go into the woods or examine the ground carefully about any of the pine trees large enough to produce cones, the chances are that here will be found quantities of young pine seedlings. These seedlings usually struggle along throughout that season and, if in the deep shade, make no perceptible growth, dampen off after heavy rains or become so enfeebled as to be unable to go through the following winter, etc.: at any rate, in the course of a few years they are gone. Not all, however, perish, as here and there in every locality some conditions out of the ordinary are to be found if one is looking for them wherein the seeds have lodged and have found ideal conditions. It so happens that some one has just cleared off a wood lot the winter following the heavy seeding or a portion of one, where just enough vegetation was left to shade certain parts. Perhaps here and there wind-falls have occurred or openings in the woods made by removing the larger trees, or the field on the north side of the woods, due to the partial shade, has been seeded in, etc. Here will be found the young seedlings in all

their glory, and it is these seedlings we have designs upon for future pine forests. When these seedlings are two years of age the stronger and better ones are ready to transplant into permanent places. They may be allowed to re-

FIG. 4. One year old and two year old white pine seedlings taken from the woods. The *second year poor* seedlings have made very little growth the second year, due to insufficient light. The *second year good* seedlings were secured from a partially open space in the same forest.

main one to two years longer, but it is a mistake to allow them to stand until the root system is large and the plants harder to dig, thus enlarging the expense; and not only this, but chances for success. Young pines, when two years

of age, will withstand the sunshine which affects the one-year trees.

Experiment.

(1) *Cost of Digging Native Pine Seedlings.* The writer in taking his forestry class into the woods always called attention to the value of the native seedlings and their importance. At different times these classes took up and transplanted seedlings of different ages to gain experience in handling and to make a study of their root development. From this experience it developed that these seedlings could readily be made to live, provided they had made two years of growth and were normally healthy. A large number of the first-year seedlings were transplanted into the nursery row with the idea of growing them where they could be shaded and given better conditons. They were so small, however, and took so much time that the idea was abandoned as not practical. When they are allowed to remain two years in the woods, provided, as already explained, that the conditions are favorable, neither too dark nor exposed to direct sunshine and in good soil, they make a large enough growth so that they are easily handled and about the right size.

In the spring of 1904, an experiment was carried out in handling a number of the native seedlings found growing in various places in the vicinity of Durham. All of the seedlings came from the seed crop of September, 1901. Many of the students at the New Hampshire College help defray their expenses while attending the institution, and it was these boys who did the work under the supervision of one of their own number, Mr. W. P. Flint, who is specializing in forestry.

The work of digging was begun on April 18th. The best method for digging was found to be by the use of the nurseryman's hoe. This implement is not in common use, but can be had from such a firm as Joseph Breck & Co., of Boston, or ordered through any good hardware dealer. It

is similar in many ways to the ordinary potato hook, only having two prongs which are longer, and the whole casting somewhat heavier. By the use of this tool one man can loosen up about as many as two men can pull or pick up. One quick man can follow fairly well. These seedlings need a little care in lifting, however, after being loosened by the hoe. Where they have grown in sod ground as is often

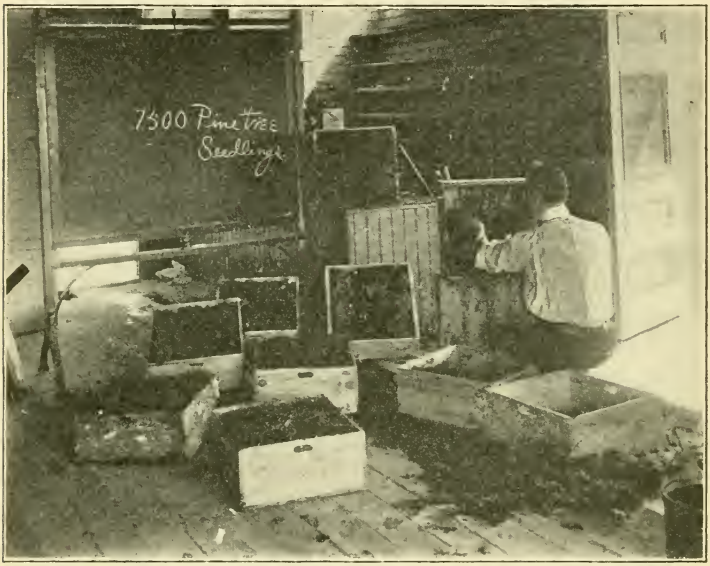

FIG. 5. Packing white pine seedlings for shipment, using the Boston market bushel box.

the case in the meadow at the edge of the woods, one man can loosen as many as three men can pick up as they should be handled. It sometimes happens, however, where seedlings are growing in fine, deep, rich leaf mould that, if gathered at the right season, they will come up as rapidly as one can pick them, so easily do they free their roots from the soil.

A man can hold about twenty-five trees in his hand easily and when this number has been pulled they may be put in

small piles or baskets, protecting the roots from the sun. Averaging all conditions which varied from sod to those grown in leaf mould, each man averaged from 175 to 250 trees per hour. It is a safe estimate to say that seedlings of two years of age can be dug for about 75 cents per thousand when moderately thick.

(2) *Cost of Packing.* Where the trees are not to be shipped, of course this item of expense is not reckoned. Where they are to be shipped, however, the best method we could devise was to use the ordinary Boston market bushel box. As shown in the accompanying photograph, they can be placed flatwise in two tiers, the roots coming together in the center of the box, where damp sphagnum moss is packed about them; or the box is placed on its side and the seedlings are laid one on top of the other, the roots towards the bottom. The bottom of the box is first packed with damp sphagnum. When the boxes are filled, slats are nailed over the top to hold them in place. By the first method 600 trees can be packed in a bushel box, and there is little danger of their heating or drying out. If wet occasionally, they have kept for several weeks thus packed.

The other method enables one to pack the seedlings much closer in the box and those thus packed averaged from 1,200 to 1,400 trees. The latter method of packing is the quicker and cheaper, but not adapted for shipping long distances. For most purposes, however, it is the more practical, as they will stand shipment for a week or even more thus packed, before being transplanted. The cost of packing is nominal. If the seedlings are handled well when pulled and kept in bunches of twenty-five each with roots and tops together, one man can pack ready for shipment 20,000 in one-half day. The bushel boxes are worth 10 cents each. In the 22,000 dug no account was made in the packing, but all was included in the 75 cents per 1,000 as cost of digging and packing. If packed according to the first method named, it would take twice as long as when stood up in the bushel box.

(3) *Cost of Transplanting.* In transplanting, placing the trees in pails containing some water in the bottom, or better a thin solution of water and soil (puddled), will prevent the roots from drying out. In setting, two men can work to better advantage, one using a spade or heavy dibble, which is thrust into the soil making a hole, while the other follows with the seedling tree, placing it in the opening and pressing the earth firmly about the roots.

It was found that two men under favorable conditions could set on an average about 400 seedlings per hour. Where it was easy digging and the soil friable, this number could be increased, but when setting in a tough sod not so many could be handled. The number of acres set and expense of the work will depend upon the distance they are set apart. When set 8 x 8 feet, it required 680 per acre and at a cost of setting approximately 50 cents per acre. Set 5 x 5 feet ordinarily recommended, it takes 1,742, or at the rate of about $1.50 per acre.

(4) *Cost of Digging and Transplanting.* Taken together, therefore, the total expense of digging and transplanting wild seedlings amounted to only approximately $1.50 a thousand. This low figure places the problem of restocking lands adapted to the growth of the white pine beyond question as an economic one.

When it is more generally known, the writer feels confident that this simple and practical solution will be very generally practised.

Time of Year to Do the Work.

The best time for transplanting the young pine seedlings is very early in the spring. As soon as the frost is out of the ground begin the work. At this time of the year the atmosphere is laden with moisture, the soil does not dry out and everything is favorable for the plant. The earlier the work is done, the more time the young trees have to become well established before the trying time of summer sets in. The month of April has been found the best time in this

climate. Much will depend upon the season, a wet season being more favorable for transplanting trees than a dry one. The continued and frequent rains of last season (spring of 1904) gave ideal conditions for setting out young trees, and even those set the last of May came through successfully. The great danger to these young trees comes during the first year after transplanting and an extremely dry season is their most dangerous pitfall. Of course, the nature of the soil in which they are planted is an important factor. Where the soil is liable to be affected by drouth it will often pay to do some watering the first year. This is true not only of native seedlings but of the nursery-grown stock as well.

How to Favor the Production of Natural Pine Seedlings for Future Use. (Nature's Nursery Assisted by Man.)

In the spring of 1902, following a heavy seeding year, quantities of seedlings sprang up throughout the college forest and a small area, well adapted for the purpose, was set aside for carrying on an experiment in thinning for improved forest growth and to see also if the self-sown seedlings could not be further developed for planting purposes. The average size of trees cut was six to eight inches in diameter, with an occasional larger one. The better trees were allowed to remain and all others, including the larger ones, were cut. The accompanying photograph, where two students are at work digging seedlings, shows this tract after thinning was done. Before cutting, the trees to come out were spotted, taking a chip off each so they were easily distinguishable. The chopping was contracted for by the thousand board measure for those that were sawed and by the cord for the remainder. It was necessary to pay a little more for this labor, but choppers were thus satisfied and did the work well. It requires more painstaking on the part of the choppers where they do not take everything clean as they go, but with a little direction and planning it costs but little more.

The results of this thinning were that the seedlings came up thickly as usual, but on account of proper conditions of light and shade they made a strong and healthy growth. Not only did the large trees left standing serve to soften the light, but fire weed sprang up in sufficient quantities to protect the small trees that otherwise might have suf-

FIG. 6. Forestry students replanting forest land to white pine. Part was planted with seed and remainder set with seedlings.

fered. These weeds are annuals and therefore are killed down at the approach of frost.

The seedlings taken from this area the past year were especially strong and healthy; as valuable as most nursery-grown stock. This practice of assisting the growth of seedlings can be carried out easily on most farms to advantage and at no extra cost.

There Are Differences in Wild Seedlings.

The writer does not wish to convey the impression that all wild seedlings of two years or more of age are adapted to transplanting directly into permanent places. One can easily determine the qualities desired in a seedling after a little experience. Only those that are of healthy color, have made good growth, and are handled carefully when dug, will survive. It is believed there are many more of these seedlings to be had than most people realize. Where they are not as strong as desired it may pay to transplant them to the nursery row for a year or two.

Cost of Using Wild Seedlings Compared With Purchasing Nursery-grown Stock.

No one will dispute but that well-grown nursery white pine seedlings are usually better than those taken from the woods. When we consider, however, the expense and transportation risk involved in obtaining the nursery-grown stock, it would appear that the native can be used practically, while the other can not.

The writer purchased, a few years since, one hundred thousand four- to six-inch pine seedlings from an Illinois nursery. The price secured was $3 a thousand, plus $20 for packing the lot, which was the lowest price possible at the time. These were dug early and sent by freight, taking four weeks to reach their destination. They were transplanted into the nursery row, where they were allowed to remain for a year and then set into permanent quarters. Only about seventy-five per cent. withstood the long transportation and the two handlings. The expense of handling twice, use of land, culture, etc., amounted to approximately $280. If to this sum $320, the first cost, is added, it makes $600, the total cost. The seedlings thus handled when set 5 x 5 feet as commonly recommended covered an area of 43 acres. The cost per acre, therefore, was about $14. If to this amount is added the price of land, taxes, insurance

against fire, etc., and then compound interest computed upon the whole, for a time sufficient to grow a crop, the result will give the total cost. Without going into the question in detail, it is believed that the undertaking would be considered a questionable one at the present time. Prices may guarantee such an expenditure in the future.

FIG. 7. The Staminate and Pistillate flowers of the white pine. These appear a year before the cones develop; hence it is an easy matter to determine a year in advance of a seed crop.

These figures may be high. Perhaps the trees had best been set into permanent places first and the expense lessened by one handling. Another time a larger percentage might live, etc. On the other hand, present prices in New England from nurserymen for white pine seedlings are many times higher than those quoted, and even Western

nurserymen have advanced in price. I was recently told by an expert forester that he is unable this year to get 4 to 6-inch seedlings anywhere for the price named, $3 per thousand. While the risk of transportation and handling may be lessened, there are equal chances for the percentage of trees not surviving, to be increased; depending largely upon the season and proper handling and transplanting.

When we compare the above figures of $14 per acre or even $10 per acre with that of the expense of taking up wild seedlings on your own farm and setting them out at an expense of only $1.50 a thousand, as shown in a previous experiment or at a cost of less than $3 per acre, it is easily seen there is a wide difference. Even if the latter expenditure reached $5 per acre, thus allowing for purchasing the wild seedlings, and selecting only the better trees, it still would be much nearer a practical forestry operation.

This comparative cost of purchasing nursery-grown stock at present prices, and utilizing wild seedlings, is given here because at present the demand for seedlings is for immediate use. People want seedlings now and will not wait to grow their own seedlings, which, of course, would be another question as regards expense. It may be said also on behalf of the nurseryman, in the past the demand has not guaranteed his growing seedlings on a sufficiently large scale to meet practical forestry prices. Nursery-grown trees, especially here in New England, have been grown for ornamentation, in planting hedges, and general landscape gardening. With an increasing demand the business will increase and prices become much lower.

Sizes of Seedlings to Use for Transplanting.

There is a prevalent idea that if the native or wild pine trees are to be transplanted they should be at least a foot or more in height. Nothing can be more erroneous. The larger the seedling or young tree, the more expensive it is to take it up and set it out and the harder it is to make it live. The older the tree, the larger its root system, hence

difficulty in digging without hurting it. It has been demonstrated that young pine trees will withstand bright sunshine after they are two years of age, provided they have had sufficient light and normal conditons for development.

Fig. 8. This and next year's crop of cones growing on the same tree and at the same time.

When they are between two and four years of age, they are small and easy to handle, their root system sufficiently developed so they can be dug without much injury, and the work of resetting them far less complicated.

How to Secure Wild Seedling White Pines.

The writer has had considerable inquiry as to where these seedlings can be obtained. We desire to assist everybody we can; so if any one has seedlings for sale, or cares to purchase them, the horticultural department of the Experiment Station will be glad to hear from them. Arrangements are being made already about Durham to furnish a limited number and doubtless others can be induced to take up the matter in different sections if the demand is sufficient. This information should be given at once to get the benefit this season.

Further Information Regarding Growing Seedlings Yourself.

Bulletin No. 95, of this Experiment Station, tells you how to collect your own seed. Another bulletin, No. 29, Division of Forestry, U. S. Department of Agriculture, Washington, D. C., entitled "The Forest Nursery," by Mr. George B. Sudworth, contains most valuable information along forest nursery lines. Both of these bulletins can be had by writing for them.

SUMMARY

1. By making use of our wild pine seedlings it is believed a beginning can be made in practical forestry the benefits of which can be little realized at present.

2. There are undoubtedly white pine seedlings growing on most farms. They need attention. Collect the surplus seedlings and transplant them on your waste lands.

3. Utilize the small pine trees upon your own farm for forestry purposes before purchasing nursery-grown stock.

4. Wild or native seedlings should be strong and healthy, not less than two nor more than four years old for best results.

5. Experiments show that the wild seedlings can be dug for 75 cents a thousand where moderately thick, and trans-

planted at varying prices, according to the nature of the soil, from 75 cents upwards.

6. Handle young pine trees as soon as the frost is out of the ground and before growth begins.

7. Much can be done to assist the development of the wild seedling. See page 59.

8. Comparative cost: Wild seedlings vs. nursery-purchased stock at present prices for practical forestry would seem to be in the same proportion as success vs. failure.

9. If each person will establish his own nursery, or assist nature's nursery in producing seedlings, the minimum cost can be secured.

10. The reason for the present high prices for nursery-grown stock, and its scarcity, is that in the past the demand has not been sufficient for growing seedlings or transplants upon an economic forest-planting scale. Economic forestry is just beginning in this country.

11. Young pine trees from two to four years of age are handled most economically. The older and bulkier the tree the larger its root system, hence difficulty in digging without injury and the greater the expense entailed in handling and transplanting.

12. In order to accumulate data, the writer would be pleased to learn if there are available seedlings in your section, and if not, whether there is a demand for such.

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